DRAFT FINAL
FEASIBILITY STUDY

Saunders County Rural Water Study

Prepared February 1998

by the U.S. Army Corps of Engineers
Omaha District

Lower Platte North Natural Resources District

U.S. Army Corps of Engineers

Rec'd 2/9/98

List of Acronyms

ARDC	Agricultural Research and Development Center (University of Lincoln)
DNT	Dinitrotoluene
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act (also known as Superfund)
COCs	Chemicals of Concern
CWA	Clean Water Act
EA	Environmental Assessment
EPA	Environmental Protection Agency
HMX	P 1-9 Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (explosive)
LPNNRD	Lower Platte North Natural Resource District
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MGD	Million Gallons per Day
NEPA	National Environmental Policy Act
NOP	Nebraska Ordnance Plant
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine cyclonate (explosive)
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level (not enforceable)
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TNB	Trinitrobenzene
TNT	Trinitrotoluene
UIC	Underground Injection Control
UNL	University of Nebraska Lincoln
USACE	U.S. Army Corps of Engineers

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1. Introduction to Feasibility Study

The Lower Platte North Natural Resource District (LPNNRD) contracted with the U.S. Army Corps of Engineers (USACE) Federal Section 22 Funding (Planning Assistance to States) to conduct this Rural Water Distribution System Feasibility Study on behalf of several communities. These communities include Ashland, Lincoln, Wahoo, Cedar Bluffs, Ceresco, Colon, Mead, Morse Bluff, Prague, Valparaiso, Malmo, Weston, Woodcliff housing development, Saunders County, University of Nebraska-ARDC and LPNNRD. The primary reasons for initiating this Feasibility Study include: concern that the current quality and quantity of drinking water sources available in Saunders County may not be adequate; public perceptions that the long-term remedial pump and treat action at the former Nebraska Ordnance Plant may eventually dewater the local aquifers; and fear forthcoming federal regulations requiring more stringent analytical sampling and mandatory disinfection of public water supplies may prove to be cost-prohibitive for many of the above named small communities. The objectives of the study are to determine the economic feasibility of utilizing the treated groundwater from the remedial treatment plant for a potable water supply, and constructing/operating a number of different water distribution systems for a new rural water system.

This Feasibility Study addresses various issues such as present and future potable water demands in Saunders County, public acceptance of using contaminated groundwater from the former Nebraska Ordnance Plant, permitting and regulatory issues, feasibility and cost of treating this groundwater to drinking water standards, and associated construction and O&M costs for the following distribution scenarios:

- All water injected into the aquifer (possible baseline scenario)
- All water surface discharged to the Platte River (possible baseline scenario)
- All water going to Lincoln and the University's Agricultural Research and Development Center (ARDC)

- Water going to Lincoln and the communities enroute, including the ARDC
- A county-wide system with trunk lines to members (existing community water supply systems would provide peak demand flow).
  - Trunk and box system that any person or organization can buy into
  - Lincoln absorbs non-peak flow
  - Rural Water District versus Inter-local Agreement (does not apply to the baseline scenario, discharge all water into the Platte River or inject into the aquifer)
- County-wide system, with non-peak flow being discharged to the Platte River
- County-wide system, with non-peak flow being injected into the aquifer
- All water going to communities in the eastern half of Saunders County

Any questions regarding this study may be directed to Mr. Gary Sasse, US Army Corps of Engineers Omaha District, at ph (402) 221-4316.

2. Water System Demands

In order to determine the economic viability of constructing a water distribution system in Saunders County, population and water demand had to be determined for all towns and rural residences, and for any rural businesses that would potentially place large demands on the system.

2.1 Water Demands for Towns

Each of the communities participating in this study is currently providing potable water to their residents via wells and small distribution systems. The following table enumerates how many people each community system is serving, how many hook-ups, the average and peak daily demand, and the water storage capacity (either elevated storage tank or cistern) available at each town:

Town	*People Served*	*Utility Hook-ups*	*Ave. Daily Demand) (Gallons)*	*Calculated Per Capita (Gal. per cap.)*	*Peak Daily Demand (Gallons)*	*Calc'd Peak:Ave Ratio*	*Water Storage (Gallons)*
Ashland	**2,138**	**853**	**310,000**	**145**	**650,000**	**2.1**	**300,000**
Cedar Bluffs	**591**	**265**	**74,000**	**125**	**250,000**	**3.4**	**150,000**
Ceresco	**825**	**350**	**160,000**	**194**	**300,000**	**1.9**	**300,000**
Colon	**150**	**68**	**25,000**	**167**	**43,000**	**1.7**	**6,000**
Malmo	**114**	**52**	**10,000**	**88**	**26,000**	**2.6**	**25,000**
Mead	**520**	**200**	**96,000**	**185**	**120,000**	**1.3**	**35,000**
Morse Bluff	**150**	**-**	**20,000**	**133**	**50,000**	**2.5**	**60,000**
Prague	**280**	**-**	**38,000**	**136**	**80,000**	**2.1**	**110,. 000**
Valparais o	**500**	**240**	**82,000**	**164**	**200,000**	**2.4**	**150,000**
Wahoo	**3,800**	**-**	**597,000**	**157**	**1,492,000**	**2.5**	**750,000**
Weston	**300**	**-**	**36,000**	**120**	**110,000**	**3.1**	**30,000**
Woodcliff	**300**	**340**	**90,000**	**300**	**150,000**	**1.7**	**80,000**
UNL ARDC	**Varies**	**NA**	**360,000**	**NA**	**360,000**	**NA**	**(2)100,000**
	9,668	**2,368**	**1,898,000**		**3,831,000**	**3.8**	

Table 2.1 Current Community Water Supply Information.

NOTES: Data obtained from town and village clerks, where available. UNL ARDC information includes water demand for domestic, livestock, and miscellaneous uses, irrigation flow not included.

It is customary when designing any system to oversize it so that it will be adequate for the next 20 to 25 years. This accommodates future growth of the County and ensures that the system is not immediately obsolete. Therefore the population and water demands listed in table 2.1 were projected 20 years into the future, to the year 2017, and listed in Table 2.2. The water distribution system was sized based on the future population presented in the following table:

Town	*People Served 1997*	*Projected Growth Rate[(a)]*	*People Served 2017*	*Average Daily Demand 2017 (gal)*	*Peak Daily Demand (gal)*
Ashland	**2,138**	**1.60%**	**2,950**	**428,000**	**897,000**
Cedar Bluffs	**591**	**1.60%**	**800**	**100,000**	**338,000**
Ceresco	**825**	**1.60%**	**1,150**	**223,000**	**418,000**
Colon	**150**	**1.60%**	**200**	**33,000**	**57,000**
Malmo	**114**	**1.60%**	**150**	**13,000**	**34,000**
Mead	**520**	**1.60%**	**700**	**129,000**	**162,000**
Morse Bluff	**150**	**1.60%**	**200**	**27,000**	**67,000**
Prague	**280**	**1.60%**	**400**	**54,000**	**114,000**
Valparaiso	**500**	**1.60%**	**700**	**115,000**	**280,000**
Wahoo	**3,800**	**1.60%**	**5,200**	**817,000**	**2,042,000**
Weston	**300**	**1.60%**	**400**	**48,000**	**147,000**
Woodcliff	**300**	**1.60%**	**400**	**120,000**	**200,000**
UNL ARDC	**Varies**	**NA**	**Varies**	**500,000 [(b)]**	**500,000**
Total	**9,748**		**13,250**	**2,607,000**	**5,256,000**

Table 2.2 Projected Water Consumption for Towns (Year 2017)

(a) population growth projection based on statistics collected from the Bureau of Business Research at UNL for Saunders County.
(b) Assumed increase in demand for UNL ARDC.

2.2 Water Demand for Rural Residents

The 1995-96 TAM Service (Township Maps Alphabetical Locator Mailing List) was used to identify just over 2000 rural residences in Saunders County. One thousand (or approximately half) of these residences were surveyed by mail to determine their family demographics, their water consumption rates, and to gauge their interest in purchasing reclaimed potable water from the NOP. The survey is available in Appendix A of this document. The results are listed by Township in the table below for the readers' information. (Since past experience with similar surveys indicates that individuals with unmetered supplies tend to grossly underestimate their water consumption, the surveys requested the consumer estimate water consumption *activities* instead e.g. showers, baths, faucet and toilet uses, laundry, livestock, etc. The water consumption resulting from these activities was then estimated using industry standards. Water from heat pumps was excluded from the calculations, as were all livestock herds greater than 20 head if the owner indicated that plenty of water was available. It was assumed that separate wells would be maintained for these two activities and therefore they would never draw upon the rural water system.

Township	Number of Residences in Township[d]	Percent (%) Represented By Survey	Est. Percent Households Interested	Ave Daily Water Use [e]	Peak Hour Water Use [f]
Ashland	47	15	43	8,700	21,750
Bohemia	62	8	0	0	0
Cedar	79	14	18	6,100	15,250
Center	112	14	19	10,100	25,250
Chapman	95	18	28	12,300	30,750
Chester	78	14	20	5,600	14,000
Clear Creek	102	17	44	20,300	50,750
Douglas	81	17	31	9,700	24,250
Elk	111	16	20	14,100	32,250
Green	83	13	22	5,500	13,750
Leshara	70	16	20	4,800	12,000
Marble	76	14	18	5,600	14,000
Marietta	93	15	33	14,400	36,000
Mariposa	91	15	14	4,000	10,000
Morse Bluff	71	7	60	16,200	40,500
Newman	88	7	8	1,700	4,250
North Cedar	58	7	25	4,900	12,250
Oak Creek	98	11	23	8,200	20,500
Pohocco	141	14	15	8,600	21,500
Richland	129	12	17	8,300	20,750
Rock Creek	83	14	25	6,900	17,250
Stocking	106	19	17	9,500	23,750
Union	114	17	41	22,700	56,750
Wahoo	67	10	50	12,000	30,000
Total	2,135	12.4%	23.5%	220,200	547,200

Table 2.3 <u>Estimated Current Rural Residence Consumption</u>

(d) From the 1995-1996 TAM Service (Township Map Alphabetical Locator)
(e) Estimated using survey information and standard industry data.
(f) Assuming a peaking factor of 2.5.

These water consumption rates were also projected to meet the needs of the population 20 years from now. The expected 2017 consumption rates are as follows:

Townships	Projected (2017) Average Daily Demand (gal)[g]	Projected (2017) Peak Daily Demands(gal)[g]
Ashland	12,000	16,560
Bohemia	0	0
Cedar	8,400	11,600
Center	14,000	19,300
Chapman	17,000	23,500
Chester	7,700	10,600
Clear Creek	28,000	38,640
Douglas	13,400	18,500
Elk	19,500	27,000
Green	7,600	10,500
Leshara	6,600	9,100
Marble	7,700	10,600
Marietta	20,000	27,600
Mariposa	5,500	7,600
Morse Bluff	22,400	31,000
Newman	2,400	3,300
North Cedar	6,800	9,400
Oak Creek	11,300	15,600
Pohocco	11,900	16,400
Richland	11,500	15,900
Rock Creek	9,500	13,100
Stocking	13,000	18,000
Union	31,300	43,200
Wahoo	16,600	23,000
Total	303,000	418,000

Table 2.4 <u>Projected Rural Residence Consumption</u>

(g) population projection based on bureau of business Research at UNL

2.3 Water Demand for Rural Businesses

Nine businesses that could potentially place a substantial demand on a rural water system were identified and queried by phone as to their water consumption rates and their interest in purchasing water from a rural water system.

Company	Product/Business	Water Usage (gpd)	Interested in a Rural Water System
Anderson Thoroughbred Ranch ph (402) 944-2755	Ranch 40-60 head	1,000 (well)	NO
Ashland Ready Mix ph. (402) 944-2018	Concrete	1500 (well)	NO
B&B Landscaping ph. (402) 624-3505		Could not Contact	N/A
Black Feed & Supply ph. (402) 624-5030		Could not Contact	N/A
Darling International Inc. ph. (402) 443-4122	Rendering Plant 3 million lbs/week	Could not provide estimate of usage. (well)	NO
Mead Cattle Co. ph. (402) 624-2995	Cattle Feedlot 20,000 head	400,000	NO
Mid America Ind. Ph. (402) 624-6611	manufacture expanded polystyrene foam	600	NO
Todd Valley Farms ph. (402) 624-6385	Farming	City Water	N/A
Wahoo Horse Livestock Express ph. (402) 642-5432	Hauling Livestock	250	YES ($50/month)

Table 2.5 <u>Water Demand for Rural Businesses</u>

Considering these results, it appears that demand created by rural businesses would be negligible.

3. Proposed Source of Groundwater

The LPNNRD proposes utilization of reclaimed groundwater from beneath the former Nebraska Ordnance Plant as its water source for a new rural system. The groundwater at this location is currently contaminated with explosives and solvents. Treatment, removing these contaminants and potentially others (as discussed within this study), would be required to provide water meeting drinking water standards.

3.1 Location

The former Nebraska Ordnance Plant is a 17,250 acre tract of land, located ½ mile south of Mead and 30 miles West of Omaha in Saunders County. The facility is nestled in the Todd Valley, an abandoned stream channel of the ancestral Platte river.

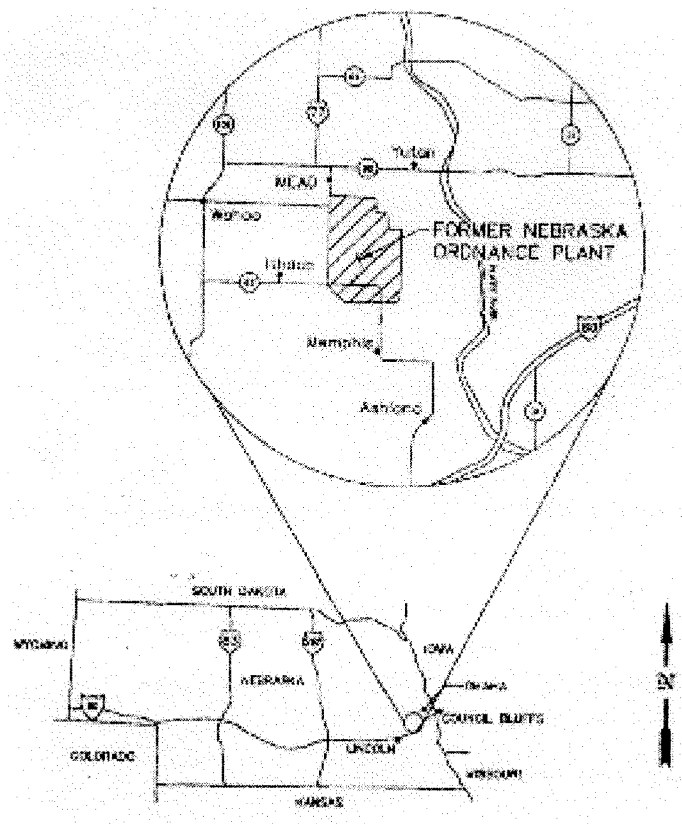

Table 3.1 Site Location of the former Nebraska Ordnance Plant

3.2 The Nebraska Ordnance Plant

The Nebraska Ordnance Plant manufactured various munitions for World War II in the 1940's and for the Korean Conflict in the 1950's, before being placed on standby in 1956. The facility itself is comprised of an administration area, an ammonium nitrate plant, a bomb booster assembly plant, four bomb load lines, demolition grounds, a sewage treatment plant, analytical laboratories, a laundry, vehicle and equipment maintenance shops, and several square miles of bermed munitions storage igloos and magazines located north and south of the load lines. The facility was placed on the National Priorities List (NPL) in 1990 under the Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA), also known as Superfund.

The Plant is no longer operational and the land had been sold off to the University of Nebraska Agricultural Research and Development Center, the U.S. Army National Guard and Reserves, the U.S. Department of Commerce, and several private interests.

3.3 Contamination in Groundwater

The groundwater at the former Nebraska Ordnance Plant is contaminated in two underlying aquifers -- The Todd Valley aquifer and the Omadi Sandstone aquifer. The principal contaminants are the solvent TCE (trichloroethylene) and the explosive RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine cyclonate). HMX (P 1-9 Octohydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) and TNT (trinitrotoluene) have also been found but in lesser amounts.

The contaminant plumes emanate from the site in a southeasterly direction, in keeping with the hydraulic gradient of the groundwater table. The boundaries of the RDX and TCE contaminant plumes are shown in Figure 3.2. (Since RDX and TCE are the primary contaminants and are the most ubiquitous, they define the outer areal limits of the plumes.)

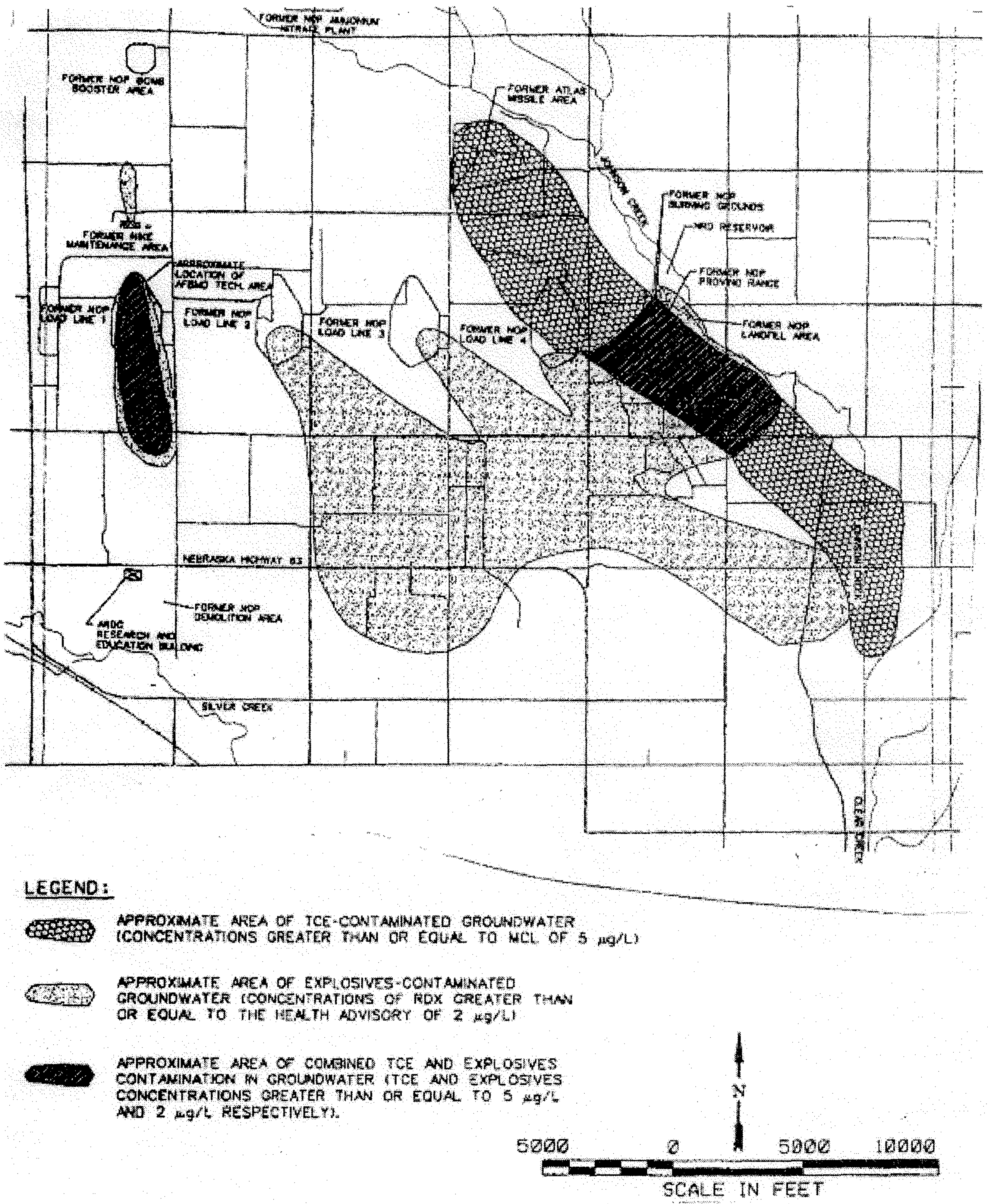

Table 3.2 <u>**Areal Extent of Contaminant Plumes (TCE and RDX)**</u>

3.4 Record of Decision

The Federal Government has agreed to remediate the solvent and explosive contamination at the Nebraska Ordnance Plant and is currently in the process of designing a final remedial action for the site. This action will consist of removing approximately 4.75 million gallons of contaminated water from the aquifer per day, via containment and focused extraction wells spaced out along the leading edge of the plume. The exact locations of these extraction wells have not yet been determined, however they will be situated so that they can contain the contaminant plumes and prevent further migration. Extracted groundwater will be treated to reduce the identified contaminant concentrations to acceptable regulatory levels for the appropriate discharge pathway.

4. Expected Influent Water Quality

The Record of Decision (ROD) detailing the final remedial action for groundwater at the Nebraska Ordnance Plant was approved in April of 1997. The remedial action proposed by the Government included establishing groundwater wells to intercept and hydraulically contain the contaminant plumes. These wells will produce a total of approximately 3300 gpm (or 4.75 mgd) for the next 80 to 120 years from the Todd Valley and Omadi aquifers. Since exact locations of these extraction wells have not yet been established, expected contaminant concentrations are stated as a range rather than an absolute in the following discussion.

4.1 Contaminant Concentrations

In order to estimate the influent concentrations, several sources of information and data sets were assessed. Seven Chemicals of Concern (COCs) were identified in groundwater samples at the site. Of these Contaminants, only two are expected to exceed their target concentration in the influent: TCE and RDX. The target concentration indicates a threshold above which the chemicals could pose a threat to human health or the environment.

Chemical of Concern (COC)	Target Concentration (ug/L) [a] [b]	Estimated Influent (ug/L) [c]
Methylene Chloride	5	<<5
1,2-dichloropropane	5	<<5
TCE	**5**	**200-630**
TNB	.778	<<.778
TNT	2	<<2
2.4-DNT	1.24	<<1.24
RDX	**2**	**3-20**

Table 4.1 Contaminants of Concern

(a) Target Concentrations derived from Maximum Contaminant Levels and Health Advisories.
(b) RoD, Woodward Clyde, Oct 1996.
(c) Groundwater Treatability Study OU2, Woodward Clyde May 1996

4.2 Other Water Quality Parameters of Concern

Other water quality parameters that may affect the initial treatment process and ultimately the desirability of the water for a drinking water source include aluminum, barium, manganese, nitrates, total dissolved solids (TDS), iron, and sulfates. Except for the Army's "contaminants of concern" for focused remediation, no groundwater modelling exists to predict the influent concentrations of other parameters. As a result, a statistical evaluation of existing water quality data taken from monitoring wells on the site was conducted as part of this study. This was not intended to replace the need for more groundwater modelling, but provided a quick overview of general groundwater conditions. Water quality data, collected from monitoring wells located on the Former Nebraska Ordnance Plant, were requested from Woodward-Clyde. With the exception of the nitrate testing, data was supplied for sampling events occuring over the period of August 1992 through June 1995. Nitrate data provided was for the period of August 1992 through December 1994, in addition to one sample in March 1995 and two samples in June 1995.

Table 4.2 lists the maximum, minimum, average and median values obtained from the sampling events, as well as the applicable Primary or Secondary Maximum Contaminant Levels (MCLs and SMCLs respectively) set forth by the Safe Drinking Water Act.

The MCLs found in the Primary Drinking Water Standards establish health-based quantitative limits for identified constituents and as such, are enforceable by the EPA for all public water systems. All constituents in the water supplied to consumers must be at or below the MCLs. Secondary MCLs as stated in 40 CFR Part 143 "*control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist as well as aesthetic degradation. The regulations are not Federally enforceable but are intended as guidelines for the States.*". Generally these are utilized for screening the palatability of a potential water source. Water exceeding the SMCLs may inconvenience the user either by taste, odor, or fixture staining, but do not adversely impact health unless present at "considerably higher concentrations". Typically, treatment to reduce constituents in the SCMLs is usually cost prohibitive, particularly for smaller public water systems. This is in part due to the water treatment technologies suitable for removal or reduction of these constituents and the waste or rejection streams generated by several of these technologies (i.e. ion exchange and reverse osmosis). Typically residents native to the area are acclimated to many of the constituents contained in the SMCL listing if current well supplies are located in the same aquifer. A more comprehensive list of allowable Primary and Secondary concentrations is provided in Table 4.3.

Constituent	Chemical Group	No. of Samples	Maximum Value	Minimum Value	Average Value	Median Value	MCL or SMCL
Aluminum (mg/l)	Dissolved	343	0.31	0.02	0.09	.09	0.05 to 0.20
	Total	343	26.30	0.02	0.51	0.13	SMCL
Barium (mg/l)	Dissolved	343	0.81	0.02	0.20	0.18	2
	Total	343	0.81	0.00	0.19	0.17	MCL
Iron (mg/l)	Dissolved	343	1.95	0.01	0.24	0.03	0.3
	Total	343	29.10	0.01	0.63	0.03	SMCL
Manganese (mg/l)	Dissolved	343	6.95	0.0001	0.17	0.001	0.05
	Total	343	6.74	0.0002	0.18	0.006	SMCL
Nitrate-Nitrite-N (mg/l)	WQ2	534	660	.05	20	3.3	10 MCL
Sulfate (mg/l)	WQ2	299	1910	5	103	51	250 SMCL
Total Dissolved Solids (mg/l)	WQ2	523	10,000	160	440	360	500 SMCL

Table 4.2 Monitoring Wells Testing Results

Primary Drinking Water Standards

Volatile Organic Chemicals	MCLG, mg/L (goal)	**MCL, mg/L (enforceable)**
Trichloroethylene	zero	**.005**
Carbon Tetrachloride	zero	**.005**
Vinyl Chloride	zero	**.002**
1,2-Dichloroethane	zero	**.005**
Benzene	zero	**.005**
1,1-Dichloroethylene	.007	**.007**
1,1,1-Trichloroethane	.2	**.2**
p-Dichlorobenzene	.075	**.075**

Secondary Drinking Water Standards

Contaminant	Secondary Maximum Contaminant Level (non-enforceable)
Chloride	250.0 mg/L
Color	15.0 color units
Copper	1.3 mg/L
Corrosivity	Non-corrosive
Fluoride	4.0 mg/L
Foaming agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3.0 (threshold odor number)
pH	6.5-8.5
Sulfate	250. mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

	Proposed SCMLs, mg/L
Aluminum	0.05
Dichlorobenzene, *o*-	0.6
Dichlorobenzene, *p*-	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
Pentachlorophenol	0.001
Silver	0.09
Toluene	1.0
Xylene	10.0

Table 4.3 Safe Drinking Water Act Standards

4.3 Conclusion

As identified in Table 4-2, a wide range of concentration values have been observed in the monitoring wells on-site. Values for each parameter vary among the wells and with sampling event. Groundwater modelling, taking into account the actual placement of the extraction system wells and the pumping rates of each, would be required to accurately predict the expected influent water quality. However, based on the Table 4-2 it would appear that iron and manganese, could exeed SMCLs and nitrates could exceed the MCL. Iron and manganese concentrations may be affected (i.e. reduced in concentration) by the selected remedial groundwater treatment technology if oxidative processes are utilized.

However of greater concern, from a potable water source consideration, is the likelihood that nitrate levels could exceed the MCL, requiring additional treatment for removal/reduction. Of the 534 nitrate samples, 110 were 10 mg/l or above. Comparison of the median value of 3.3 mg/l to the average value of 20 mg/l indicates that there were a number of samples that had extremely high concentrations. Cursory analysis of the nitrate data was conducted during this study to identify locations where nitrate levels have exceeded the 10 mg/l MCL. A map, included in Appendix B indicating monitoring wells locations, was color coded to indicate the number of occurences during the sampling period that the 10 mg/l concentration was exceeded. The results indicate that nitrate levels have exceeded 10 mg/l in a wide distribution of locations on the site. The majority of the contamination occurred in shallow and intermediate wells, while just 5 of the those were in 5 different deep wells. The following table provides a breakdown of nitrate results according to sampling date and the number of samples collected during that activity. Neglecting the two most recent sampling events (December 1994 and Mar/June 1995) with relatively few samples, it would appear that a general downward trend in nitrate levels is occurring.

Testing Dates	Max (mg/l)	Min (mg/l)	Ave (mg/l)	Median (mg/l)	Number of Samples
Aug-92	660	0.2	50.5	4.2	128
Nov-92	500	0.2	14	3.5	128
Feb-93 to Apr-93	80	0.2	7.1	3.3	128
May-93 to July-93	60	0.2	5.5	2.5	139
Dec-94	442	0.1	70.8	10	8
Mar-95 to June-95	45.8	4.1	30.3	41	3

Table 4.4 **Nitrate Test Results by Sampling Date**

Changes in soil nutrient management, on and adjacent to the ARDC, in the form of land application of livestock waste may have a direct impact on the nitrate levels. Without further review of those changes it is difficult to confirm that association. Obviously, as is the case for any type of nitrogen application, overapplication at rates greater than that of the agrinomic rate of the soil and crop grown will present a potential for groundwater contamination.

Without additional study, the water quality data studied in general suggests that extracted groundwater (or remedial treatment plant influent) is likely to be at or above acceptable nitrate concentrations for a public water supply. This statement is based upon the arithmetic average of the data samples. Treatment for nitrate reduction would therefore be required to make it an acceptable public supply. While it may be possible to situate extraction wells in lower nitrate level areas, or to pump them at rates that minimize the movement of higher concentration plumes toward them, these measures may or may not correlate to the best placement and operation of the remedial extraction system for remedial groundwater treatment. Costs for nitrate removal are therefore included in all public water supply scenarios identified in Section: COST.

5. Expected Effluent Quality

5.1 Treatment Methods as per the Record of Decision

The Final Record of Decision was submitted to the EPA for approval in October of 1996.

The Army proposed three different treatment alternatives or combinations thereof:

1. Granular Activated Carbon (GAC) - Granular Activated Carbon is a specially processed charcoal that has been heated to increase the area and the roughness of each particle's surface. Both solvents and explosives would adsorb onto the roughened surface of these particles until all the surface area was occupied and the carbon was exhausted. This treatment method entails processing the contaminated water through large, pressurized columns of GAC until an adequate contact time has been established. This mechanism is simply a transfer of contamination from one media to another (i.e. from groundwater to carbon). When the GAC is spent it is removed and replaced with fresh carbon. The spent GAC can be regenerated by thermal processing.

2. Advanced Oxidation Process (AOP) - Advanced oxidation can refer to a number of oxidation techniques. The underlying principal is to introduce free hydroxyl radicals (OH- ions) into the extracted groundwater for chemical destruction of the contamination. These hydroxyl radicals are very destructive and will break down complex organic constituents, such as explosives and solvents, into simple, non-toxic molecules.

3. Air Stripping - The process of air stripping is also a method of contaminant transfer, rather than contaminant destruction. The contaminated water is gravity fed through stripping trays or columns of plastic packing while a countercurrent stream of air is simultaneously forced upwards. Since solvents have a low vapor pressure the air-water contact enables them to move from the liquid state to the gas state (i.e. they volatilize). The air stream is then evacuated to the atmosphere or incinerated to destroy the contaminants. This process is only effective for the solvent (TCE) portion of the contamination, air stripping must be used in conjunction with either AOP or GAC to reduce the explosive contaminants.

The Army is currently conducting pilot studies to determine which treatment, or combination of treatments, would be most effectual and economical. The final treatment method has not yet been chosen.

5.2 Pretreatment Options

Granular Activated Carbon, AOP, and air stripping are specifically designed to remove solvents and/or explosives and they work very effectively when those contaminants are the only constituent in the water stream (i.e. under ideal conditions). The natural composition of groundwater however, is considerably more complex. It can vary dramatically due to the leaching of salts and minerals from the surrounding soil and these constituents can markedly decrease the effectiveness of some treatments.

Constituents occurring in the groundwater beneath the NOP site that might cause interference with each treatment method are listed below:

Method	Constituent	Pretreatment Method Options or Preventative Measures
GAC	Suspended Solids	Filtration.
AOP	Iron Nitrates Suspended Solids Dissolved Solids	Greensand filtration,Chem. Precip., chelating agents Ion exchange, reverse osmosis, electrodialysis Filtration Ion exchange,Reverse osmosis.
Air Stripping w/ a Carbon Polisher	Iron Suspended Solids	Greensand filtration,Chem. Precip., chelating agents Filtration

Table 5.1 <u>Constituents Requiring Pretreatment or Preventative Measures</u>

The U.S. Government's current groundwater remediation treatment plant design does not incorporate any pretreatment. This decision was made by the contracted engineering consultant, based on recent selective analytical sampling and pilot treatablity studies, that none of the constituents in Table 5.1 would severely interfere with removal of TCE and RDX by the selected treatment process. Most of these constituents are borderline however, and should be monitored closely once the plant is built to ensure that they are not adversely inhibiting the removal of explosives and solvents. It should be noted however, that without pretreatment some of the constituents listed in Table 5.1 will flow through the treatment process unaffected. In the case of preventative measures, chemical addition of chelating agents and/or biocides are used to prevent scaling or chemical deposition, and biological growth on treatment equipment. These methods usually do not remove or reduce the contaminant concentration, but as for the case for chelating agents keep the contaminant in a state to prevent deposition on treatment equipment. Biocides or oxidants are occasionally used for maintenance and cleaning of equipment but not used for pretreatment.

5.3 Expected Effluent Concentrations From Remedial Action Treatment Plant

Actual remedial action plant effluent quality will not be definitively established until the plant is operational and treating groundwater. Reasonable design and operational assumptions enables an estimate of the effluent quality to be made however. A table representing the likely effluent is presented below:

Constituent	Concentration (mg/L)
Methylene chloride	<<5
1,2 Dichloropropane	<<5
TCE	<5
TNB	<<.778
TNT	<<2
2,4-DNT	<<1.24
RDX	<2

Table 5.2 Estimated Effluent Parameters

The current remedial technology for groundwater remediation will have little or no impact on the reduction of constituents identified in Table 4-2. Therefore additional treatment methods/technologies will be necessary to reduce influent groundwater concentrations to meet public water standards. As stated previously these contaminants are expected to be primarily iron and manganese, and nitrates.

6. Disposal Options For Remedial Treatment Effluent

After treating the contaminated groundwater for explosives and solvents the Federal Government will have three different disposal options:

1) Reinject treated water back into the Todd Valley and Omadi Sandstone Aquifers;

2) Surface discharge treated water to the Platte River; or

3) Transfer treated water to an entity(ies) for a potable water source;

The following discussions examine the discharge option and any additional water treatment that may be required for each scenario:

6.1 Reinject Treated Water Back Into the Omadi and Todd Valley Aquifers

In this scenario, the Federal Government would discharge the effluent from its treatment plant and convey it to a reinjection gallery. This option would help ameliorate the concerns some citizens have expressed regarding overpumping of the Todd Valley and Omadi Sandstone Aquifers, since it would result in the replacement of most of the nearly 5 million gallons a day being pumped from those aquifers. Although the primary focus of the Governmment's groundwater remediation is to remove the contaminants RDX and TCE, the water quality requirements for discharging the treated groundwater may be much more stringent. Since the Todd Valley and the Omadi Sandstone aquifers are both considered sources of potable drinking water (Class IV aquifers under the auspices of the Underground Injection Control program), the Nebraska Department of Environmental Quality has stated that it will require that all Safe Drinking Water Act Primary MCLs be met prior to allowing any water to be re-introduced into these two aquifers. In the event that nitrates do exceed 10 mg/L, additional water treatment would be necessary to reduce the effluent concentration prior to reinjection under this criteria. DEQ also retains the right to require treatment of Secondary MCLs like iron and TDS, <u>if</u> the reinjection program is in any way adversely impacting neighboring wells. This would be true even if the constituents are present in levels at or less than those present in the ambient aquifer (e.g. even if the hypothetical average iron concentration in the aquifer is 1.0 mg/L, the state could require the water be treated to 0.3 mg/L in order to meet MCLs). The consequence is that the required effluent quality could, in some extreme cases, be substantially more restrictive than the aquifers' ambient water quality.

ADDITIONAL TREATMENT CONCERNS: Responsibility for additional treatment should be decided before this option is selected. The state does retain the right to enforce secondary MCLs. Actual operational experience of the reinjection well galleries may be one factor that could necessitate iron removal. Predictions by LPNNRD, based on past experience, suggest that iron removal will be necessary because of its propensity to precipitate when exposed to oxidants, thereby clogging the reinjection galleries.

6.2 Surface Discharge Treated Water to the Platte River

In this scenario the Federal Government would convey the effluent from the treatment plant approximately 6 miles to be discharged into the Platte River. Once again, although the Government has agreed only to remove the RDX and TCE contaminants, the requirements for discharge will probably be much more stringent according to regulators at NDEQ. Since the Platte River is a source of potable drinking water, the NDEQ has a legitimate interest in protecting it. Given the quantity of water to be discharged (4.75 mgd) and the duration of the discharge (80 to 120 years) the water would in all likelihood be required to meet primary MCLs prior to discharge.

ADDITIONAL TREATMENT CONCERNS: Responsibility for additional treatment should be decided before this option is selected. The NDEQ will not definitively state numerical requirements until the application for permit is granted.

6.3 Transfer Treated Water to an Entity(ies) for a Potable Water Source

The third alternative is for the Federal Government to transfer the remedial action treated water to the LPNNRD or other entities to be used as a drinking water source. The Federal Government has agreed to provide treatment necessary for removal of only the solvents and explosives (TCE and RDX) that exceed MCLs. Any additional costs for providing water treatment beyond that required to meet the intent of the ROD would not necessarily be borne by the Government. From a primary drinking water standard perspective, it appears likely that nitrate removal will be necessary. Depending upon the entity or entities receiving the treated groundwater and their current or future capacity/capability to provide water treatment, further treatment of the supply may or may not be necessary. In the case of the LPNNRD where water treatment is not currently available, iron and manganese removal would be necessary to meet the SMCLs since the average concentrations exceed those limits. The average concentration for Total dissolved solids (TDS) is within the guidelines for SMCLs so further treatment is not required for removal of this constituent. Alternately, the treated groundwater from the remedial treatment plant may be satisfactory as a raw water source for an entity already providing groundwater treatment for potable uses, as may be the case for the City of Lincoln waterworks system. For a finished potable water supply disinfection will be required as per the new Safe Drinking Water Amendments of 1995. Disinfection will most likely be provided by chlorination. The water system will be required to maintain a free chlorine residual of 0.2 mg/L throughout the distribution system.

ADDITIONAL TREATMENT CONCERNS: Responsibility for additional treatment should be decided before this option is selected. Nitrate treatment will likely be necessary, and depending upon the receiving entity, iron and manganese reduction as well. The only additional treatment required to make the treated groundwater suitable for potable finished water is disinfection. However, depending upon the final remedial action groundwater treatment process selected for RDX and TCE removal, subsequent filtration or settling for removal of iron oxidized during either the treatment process or for chlorination may be necessary. If the selected treatment process does not create iron precipitates an additional iron removal process would be necessary to reduce the concentration to acceptable SMCLs.

7. Cost

Costs that may be incurred by the Rural Water Distribution System have been broken down into two categories: capital costs and annual O&M expenses. Cost estimates assume the following:

1. Water will be transferred from point A to point B by a water distribution line with booster pumps and pumphouses at various points where necessary.
2. All water lines will run along existing county roads in the road right-of-way (i.e. no land purchase necessary)
3. There will be 1 road crossing per mile of pipe.
4. All water lines will be buried a minimum of 5 feet below grade.
5. Power service will be available adjacent to roadways for equipment needs.
6. All pumps will be controlled remotely by a central station. The central station will be located in the water treatment plant and will control the remote stations telephonically.
7. Telephone service will be easily available where required.

Piping lengths and pump locations were determined by a hydraulic analysis package called CYBERNET (an add-on to AutoCadd utilizing KYPIPE2). The program models the distribution system, taking into account various hydraulic components such as pumps, valves, piping friction losses and storage tanks. The water line diameters and pumps have been optimally sized to minimize headloss and eliminate high-pressure zones while still providing adequate water pressure to the recipients. All line sizes were based on water demands for the year 2017 to allow for population growth. The Corps was able to obtain as-built drawings for all of these communities with the exception of Ceresco. Since every town participating in the study, as well as the ARDC, has an existing storage tank they will be able to absorb the peak daytime variations. Therefore all hydraulic modeling was based on the Rural Water Distribution System providing only *average* daily flows to each community. For purposes of this analysis it was assumed that the Rural Water

Distribution System would pump the treated water directly into the existing storage tanks and it would be distributed to consumers from that point.

Each of the scenarios set forth in the introduction is explored.

7.1 All water injected into the aquifer or surface discharged to the Platte River (baseline scenario)

Capital Costs Incurred:	
Piping and distribution	$ 330,000
Reinjection Gallery System (aquifer only) (developed from Woodward Clyde EECA 3/95 for a 2.27 MGD system at a cost of $6.7 million)	$ 14.0 million
Iron Removal (aquifer only)	$ 130,000
Annual O&M costs Incurred:	
Reinjection (aquifer only)	$ 229,000
Iron Removal (aquifer only) (includes chlorine, operator costs, and analytical)	$ 70,000
Pumping	$ 150,000

Table 7.1 Scenario 7.1 Cost Summary

7.2 All water going to the University Agricultural Research and Development Center (ARDC) with the remainder going to Lincoln (via Ashland)

Capital Costs Incurred by the Rural Water System: The capital costs consist of 60,000 linear feet of 16 inch piping, 7500 linear feet of 6 inch piping, and one pumphouse with a duplex set of booster pumps. The ARDC use excludes any use for irrigation flows. Irrigation flows will continue to be supplied by existing irrigation wells at the direction of the ARDC. All excess flow from the remedial treatment plant not utilized by the ARDC will be directed to the City of Lincoln supply system near Ashland for further treatment by Lincoln. In this scenario finished water storage (clearwell volume) would only be provided for the peak daily demand of the ARDC (500,000 gallons) to provide one day's treated volume storage for non-interruptible users. Existing water storage on the ARDC will continue to be utilized for hourly fluctuations in demand. Finished water storage for the excess flow to Lincoln will not be provided, as it will be considered an interruptible user.

Iron and manganese treatment is only provided for the portion used by the ARDC, since Lincoln provides its own treatment. Annual O&M cost for nitrate removal per million gallons per day (MGD) treated is included if relevant. If nitrate removal is necessary, the entire flow used by the ARDC must be treated. For the portion of the flow going to the City of Lincoln, treatment may or may not be necessary. The blended flow consisting of their current well supply system and this excess flow must be within the MCL, if that cannot be met, treatment may be required on a portion of the flow.

Capital Costs Incurred:	
Piping and distribution	$5.0 million
Water Storage	$500,000
Iron Removal (for portion to ARDC only)	$ 100,000
Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal (for water to ARDC only, water going to Lincoln via the Ashland Plant will not be chlorinated or filtered.)	$ 55,000
Nitrate Removal	$125,000 per million gallons treated per day (MGD)
Pumping	$75,000

Table 7.2: <u>Scenario 7.2 Cost Summary</u>

7.3 Water going to Lincoln and the communities enroute, including the ARDC. (Since water would be pumped to Lincoln via Ashland, Ashland would be the only community "enroute").

Capital Costs Incurred by the Rural Water System: The capital costs consist of 59,000 linear feet of 16 inch piping, 7500 linear feet of 12 inch piping, 1000 feet of 8 inch piping, and one pumphouse with a duplex set of booster pumps. The ARDC use does not include irrigation. The volume of water extracted and treated in excess of the demand for the ARDC would be diverted to the Ashland Plant and then onto the City of Lincoln supply system. Finished water storage (clearwell) should equal peak daily demand of non-interruptible users (the ARDC and City of Ashland) or in this case a minimum or 1.4 million gallons. Existing storage in the City of Ashland would be retained.

Iron and manganese treatment is only provided for the portion used by the ARDC. Again, under this scenario, if nitrate removal is necessary, the entire flow used by the ARDC, the City of Ashland, and potentially the City of Lincoln (see previous scenario discussion on blended flow for Lincoln) would require treatment. Since the City of Ashland does not provide any water treatment, iron and manganese treatment would need to be furnished by and in that city for its portion of the flow. Nitrate removal in the City of Ashland would also be necessary if the excess flow nitrate concentrations to the City of Lincoln are acceptable.

Capital Costs Incurred:	
Piping and distribution	$5.3 million
Water Storage	$1.4 million
Iron Removal (for portion to ARDC only)	$ 100,000
Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal (for water to ARDC only, water going to the City of Ashland and the City of Lincoln via the Ashland Plant will not be chlorinated or filtered.)	$ 55,000
Nitrate Removal	$125,000 per MGD
Pumping	$75,000

Table 7.3: <u>Scenario 7.3 Cost Summary</u>

7.4 Saunders CountyWide Rural Water System

Average daily demand placed on the system by the 12 towns and the ARDC participating in the study would be approximately 2.6 MGD with a peak daily demand of 5.3 MGD. Finished water storage (clearwell) should therefore equal 5.3 MG for these uninterruptible users. All existing water storage within the communities to be served will be retained and utilized in these scenarios, as well as all existing distribution and service lines within the same.

7.4.1 System with trunk lines to charter members.

Capital Costs Incurred by the Rural Water System: The capital costs consist of 70,000 linear feet of high pressure piping ranging from 6 to 16 inches in diameter, 833,000 linear feet of normal PVC piping ranging from 1.5 to 18 inches in diameter, and five pumphouses with duplex sets of booster pumps. Although not considered in the following cost breakdown, some form of alternate discharge for the remedial groundwater treatment plant would be required when the rural water system demand is below the design flow of 4.75 MGD. Subsequent scenarios (7.4.2 through 7.4.4) discuss these alternate excess flow discharge routes.

Under this scenario, if nitrate removal is necessary, it would be required for the entire flow to the rural water system. Iron and manganese reduction would also be required for the entire flow.

Capital Costs Incurred:	
Piping and distribution	$ 38 million
Water Storage	$ 5.3 million
Iron Removal	$ 130,000
Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal & Disinfection (for all water produced and utilized by the charter members only) (these costs would include chemicals (chlorine), operator costs (assuming one licensed operator) and annual analytical costs.	$ 82,000
Nitrate Removal	$125,000 per MGD

Pumping	$ 150,000

Table 7.4: Scenario 7.4.1 Cost Summary

7.4.2 A county-wide (towns only) system with trunk lines to charter member (Lincoln Absorbs non-peak flow).

Flows in excess of rural water system demand would be delivered to the City of Lincoln water supply system. Capital costs are the same as 7.4.1 except 33,500 feet of 8 inch pipe is changed to 10 inches.

Capital Costs Incurred:	
Piping and distribution	$ 39 million
Water Storage	$ 5.3 million
Iron Removal	$ 130,000
Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal & Disinfection (for all water produced and utilized by the charter members only) (these costs would include chemicals (chlorine), operator costs (assuming one licensed operator) and annual analytical costs.	$ 82,000
Nitrate Removal	$125,000 per MGD
Pumping	$ 150,000

Table 7.5: Scenario 7.4.2 Cost Summary

7.4.3 A county-wide (towns only) system with trunk lines to charter members (excess flow discharged to Platte River).

Flows in excess of rural water system demand would be discharged to the Platte River. Costs are the same as for 7.4.1 except 16,000 feet of 4 inch line is changed to 6 inches.

Capital Costs Incurred:	
Piping and distribution	$ 38.5 million
Water Storage	$ 5.3 million
Iron Removal	$ 130,000

Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal & Disinfection (for all water produced and utilized by the charter members only) (these costs would include chemicals (chlorine), operator costs (assuming one licensed operator) and annual analytical costs.	$ 82,000
Nitrate Removal	$125,000 per MGD
Pumping	$ 150,000

Table 7.6: Scenario 7.4.3 Cost Summary

7.4.4 A county-wide system with trunk lines to charter members (excess flow reinjected into the aquifer)

Under this scenario the costs for the rural water system are as for scenario 7.4.1. However, a reinjection gallery for the excess flow greater than the rural water demand would be required. This size of the gallery system could be reduced by the minimum rural water system demand. It would not be necessary to design the gallery for the entire 4.75 MGD as identified in the Baseline Scenario (7.1) if the minimum rural water system demand can be established.

7.5 A trunk and box system limited to the Eastern half of Saunders County (Cedar Bluffs, Colon, Wahoo, Ceresco, Mead, Ashland, and excess going to the ARDC.)

Average daily demand placed on the system by the 6 towns and the ARDC would be approximately 2.2 MGD with a peak daily demand of 4.4 MGD. Finished water storage (clearwell) should therefore equal 4.4 MG for these uninterruptible users. All existing storage tanks and distribution systems within the communities will be retained.

Capital Costs Incurred by the Rural Water System: The capital costs consist of PVC piping ranging from 6 to 16 inches in diameter and one pumphouse with a duplex set of booster pumps.

Capital Costs Incurred:	
Piping and distribution	$ 34 million
Water Storage	$ 4.4 million
Iron Removal	$ 130,000
Nitrate Removal	Variable
Annual O&M costs Incurred:	
Iron Removal & Disinfection (for all water produced and utilized by the charter members only) (these costs would include chemicals (chlorine), operator costs (assuming one licensed operator) and annual analytical costs.	$ 75,000
Nitrate Removal	$125,000 per million gallons treated per day
Pumping	$ 150,000

Table 7.7: Scenario 7.5 Cost Summary

8. Public Acceptance of Beneficial Reuse

8.1 Towns

The towns of Ashland, Lincoln, Wahoo, Cedar Bluffs, Ceresco, Colon, Mead, Morse Bluff, Prague, Valparaiso, Malmo, Weston, Woodcliff housing development, and the University of Nebraska ARDC have implicitly expressed openness to beneficial reuse of the treated groundwater at the Mead Ordnance Plant by commissioning this Feasibility Study.

8.2. Rural Residences

Approximately 1000 rural residences (farms/acreages) in twenty four townships were surveyed in conjunction with this study. The percentage of people interested as well as the average maximum amount each residence would be willing to pay per month is summarized below in Table 8.1.

Township	Percent Population Interested in Buying Water	Average Maximum Monthly Cost They Would Be Willing To Incur
Ashland	33 %	$28
Bohemia	0	-
Cedar	18 %	$40
Center	19 %	$23
Chapman	28 %	$31
Chester	15%	$27
Clear Creek	15 %	$27
Douglas	31 %	$30
Elk	19 %	$27
Green	22 %	$35
Leshara	20 %	$8
Marble	10 %	$28
Marietta	25 %	$25
Mariposa	23 %	$25
Morse Bluff	50 %	$25
Newman	0 %	-
North Cedar	25 %	$25

Oak Creek	**20 %**	**$25**
Pohocco	**11 %**	**$8**
Richland	**15 %**	**$22**
Rock Creek	**18 %**	**$30**
Stocking	**17 %**	**$28**
Union	**41 %**	**$24**
Wahoo	**20 %**	**$25**

Table 8.1 Rural Residence Interest

(survey summary included in Appendix A)

Prevailing sentiment among rural residences was negative. In general, they expressed reluctance to consume previously contaminated water, distrust of government, and unwillingness to pay for a rural water distribution system, either directly or indirectly.

9. Regulatory Considerations

NOTE: This section includes a very brief and general discussion of several different laws. To the extent that these laws become relevant or applicable to a local project or concern, legal counsel should be consulted for a legal opinion. This section is not intended to be used as legal advice to the LPNNRD or any of the communities which may read or benefit from this study.

9.1 Safe Drinking Water Act

Any and all public water supplies will have to comply with the regulations set forth by the Safe Drinking Water Act (SDWA). The SDWA protects potable water supplies (Class IV aquifers and waters of the U.S.) and ensures that all public potable water is safe for human consumption. Under this law EPA has established two standards: Primary Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels. The Primary MCLs are designed to protect against adverse health effects and as such they are enforceable. Secondary MCLs are meant to protect the aesthetic qualities of drinking water, like odor, taste, and appearance, and are not enforceable under federal law. Any public water supply that exceeds primary MCLs must notify their consumers. Primary and Secondary MCLs as promulgated by the Safe Drinking Water Act were presented in Table 4.3.

As part of the protection program for underground drinking water supplies, the SDWA establishes the Underground Injection Control (UIC) Program. This allows the EPA (or State of Nebraska since they have established primacy) to regulate any and all discharges into aquifers that may serve as potable drinking water aquifers or are hydraulically connected to potable drinking water aquifers. If reinjection of the treated water back into the Todd Valley and Omadi Sandstone Aquifers is selected, no permit would be required since it is an NPL site.

9.2 Nebraska Drinking Water Standards (Nebraska Administrative Code, Title 179, Department of Health.

State MCLs are established by this regulation. The discharge of treated groundwater will not directly impact drinking water; however, the potential for residual contaminants percolating to drinking water aquifers exists. State MCLs for COCs, where established, should be considered when establishing discharge limits for treated water.

9.3 Safe Drinking Water Act Amendments of 1996 (Public Law 104-182)

The Safe Drinking Water Act Amendment of 1996 was signed into law on August 6 of that year by President Clinton. This amendment enacts several major changes to existing law that could potentially effect any new or existing potable water system in Saunders County:

- All public water systems will be required to disinfect, beginning as soon as 1999.

- Provisions that formerly required the EPA to set new standards for 25 additional contaminants every three years have been repealed, therefore easing the extensive analytical sampling requirements that were anticipated. The Amendment does however, require the EPA to publish a list of contaminants that are not currently subject to regulations but that are known or anticipated to occur in public water systems. The EPA would then be required to promulgate standards for these contaminants (if it chooses to establish any) at the rate of five contaminants every five years based on their frequency or likelihood of occurrence, the potential health risks posed, and the cost/benefit analysis of implementing those standards. EPA is under special direction to evaluate substances that may imitate naturally occurring human estrogen or other endocrine substances.

- All public water supplies must issue a "consumer confidence report", which informs customers of the concentration levels of any unregulated contaminant as set forth by the EPA.

- "Public water system" is redefined to mean any water provided "for human consumption through pipes or other constructed conveyances". (Prior to the

Amendment Safe Drinking Water Regulations applied only to systems serving at least 7 connections or 25 people.)

- Financial assistance is provided to States in the form of grants for construction, rehabilitation, and improvement of water supply systems. Capital assistance grants would be provided by the federal government for States willing to establish a revolving loan fund. Systems could apply for low interest loans instead of the traditional method of passing new bond issues, however the loans would be subject to availability and each system would have to submit a water conservation plan to qualify.

9.4 Clean Water Act

Clean Water Act National Pollutant Discharge Elimination System (NPDES) regulations would be applicable if the construction of the treatment plant and associated facilities exceed 5 acres. Section 404 of the Clean Water Act would be invoked if the construction were take place in a delineated wetland. An NPDES permit would also be required if the site meets the Industrial Classification codes because of hazardous chemical storage or material storage (i.e. chlorine) as set forth by CFR 122.26.

9.5 National Environmental Policy Act

The Rural Water System may be required to conduct an Environmental Assessment (EA) as per Section 101 of the National Environmental Policy Act (NEPA), especially if it applies for the construction grant program legislated by the CWA. NEPA requires entities to consider and assess the environmental effects of all proposals involving federal action (read permitting) or federal funding. LPNNRD would be required to evaluate all alternatives (groundwater reinjection, discharge to the Platte River, and beneficial reuse) and consider the effects on the environment.

9.6 Water Rights

As per the Kansas District Corps of Engineers, the State of Nebraska has codified a system of groundwater use preferences. The statutes state that domestic use has preference over all other uses, and that agricultural use has preference over industrial uses. The statutes are silent with respect to use for public water supply. The wells would have to be registered with the state however there is no requirement for a pumping permit nor is there any limit to the quantity the Government can pump and dispose of.

9.7 Nebraska Department of Health Regulations Governing Public Water Supply Systems 179 NAC 2 (including amendments made through January 16, 1996)

This document sets forth the regulatory requirements promulgated by the State of Nebraska for operating a public water supply. It covers minimum standards for drinking water, filtration and disinfection requirements, and monitoring and analytical requirements. It gives guidance on siting, designing, and constructing a potable water plant and outlines requirements for licensing the plant after it's operational. Of special interest in Code Section 010, is the listing of requirements for Plant Operator Certification.

9.8 Recommended Standards for Water Works (1987 edition) Policies for the Review and Approval of Plans and Specifications for Public Water Supplies.

This document issues guidance on the construction and operation of public water treatment plants. It provides general recommendations and considerations for the design phase. It delineates source development and provides comprehensive information on numerous treatment processes.